

## Section 7.8

# THE STORMFILTER®

### 7.8.1 General Description

The Stormwater Management StormFilter® (StormFilter) cleans stormwater through a patented passive filtration system, effectively removing pollutants to meet stringent regulatory requirements. Highly reliable, easy to install and maintain, and proven performance over time, the StormFilter system is recognized as a versatile BMP for removing a variety of pollutants, such as sediments, oil and grease, metals, organics, and nutrients. The StormFilter comes in variable configurations to match local conditions and is designed with prolonged maintenance periods to ensure long-term performance and reduce operating costs.

The StormFilter is typically comprised of a precast vault or manhole that houses rechargeable, media-filled cartridges. The Volume StormFilter configuration utilizes upstream detention to contain the water quality volume (WQv) which is fed to the StormFilter at low flow rates. This configuration is considered an approved alternative to the General Standard BMPs, provided all applicable design criteria are met.

#### *Volume StormFilter Operation*

Runoff first enters the upstream detention structure where it is temporarily detained and ultimately treated by the filtration components over a 24 to 72 hour drain down period. The slow release rate allows a substantial fraction of the suspended solids and attached pollutants to settle upstream of the filtration components, which extends the life of the filtration media and reduces maintenance frequency. Flow entering the StormFilter from the detention system is

distributed to the cartridge bay by an energy dissipater/flow spreader. As the water level in the filtration bay begins to rise, stormwater enters the StormFilter cartridges and percolates horizontally through the filter media before passing into the cartridge's center tube. Inside each center tube, a calibrated float initially limits the flow rate into the underdrain manifold at the bottom of the cartridge. This causes the water elevation in the filtration bay to rise to the top of the filtration cartridges. Once the water elevation reaches the top of the filtration cartridges there is sufficient buoyant force to lift the float to the open position. The cartridge then begins operating at the design treatment rate which is regulated by a calibrated restrictor disc (orifice) at the base of each cartridge.

The combination of the float, cartridge hood and flow control orifice ensure that all available media surface area is utilized and the cartridge operates at its design operating rate. Once the float is lifted to the open position a siphon forms and the hood ensures each cartridge will maintain a hanging water column during operation until the water surface elevation in the filtration bay drops to the elevation of the scrubbing regulators near the bottom of the cartridge hood. At this point, the siphon begins to break and air is quickly drawn beneath the hood through the scrubbing regulators, causing high energy turbulence between the inner surface of the hood and the outer surface of the filter media. This turbulence agitates the surface of the filter, releasing accumulated sediments on the surface, flushing them from beneath the hood, and

allowing them to settle to the vault floor. This surface-cleaning mechanism maintains the permeability of the filter surface and enhances the overall performance and longevity of the system.

#### *Standard Cartridge Heights*

Three different cartridge heights are available at 12, 18, and 27 inches. Increasing the height of the cartridges increases the media surface area in a given footprint, but requires a greater hydraulic drop (head loss) across the system. Since each cartridge contains an individual orifice control, the calibrated restrictor disc, a consistent specific flow rate is sustained for all cartridge heights.

Applications that have additional hydraulic drop available can opt for a taller cartridge and gain the benefit of a smaller number of required cartridges and therefore a smaller system footprint. Projects with limited available hydraulic drop can select the Low Drop StormFilter (12 inch effective cartridge height). However, more cartridges will be required to provide the required media surface area, which results in a larger system footprint.

#### *Pollutant Removal*

Solids and attached pollutants will settle in the upstream detention structure as well as within the StormFilter. The StormFilter cartridge is the central treatment device within the system. Physical straining through the media promotes solids removal by trapping solids within interstitial spaces throughout the filtration media. Dissolved pollutants such as metals and phosphorous are removed by both ion exchange and adsorption processes.

#### **7.8.2 Site Suitability Criteria**

The StormFilter is well suited to most stormwater treatment applications. The system is most commonly used on small and medium sized sites but can be scaled to accommodate larger applications. Sites

without suitable hydraulic drop, excessive tailwater or atypical pollutant loads may warrant special consideration. CONTECH encourages anyone considering the StormFilter for a particular application to contact them prior to finalizing site plans to ensure the most appropriate design is specified.

**Contact** *Maine Office:* 207-885-9830 or  
*National Toll Free:* 800-338-1122

#### **7.8.3 General Design**

For standalone stormwater treatment applications in the State of Maine the StormFilter must be designed in a volume configuration and rely on a combination of fine zeolite and reactive alumina media. Sizing is based on the results of long term field monitoring that demonstrated the StormFilter is able to meet the Maine Department of Environmental Protection's (MEDEP) stormwater quality criteria. The volume StormFilter includes an upstream storage component sized to capture the water quality/channel protection volume and release it through the filtration components over a minimum of 24 hours. Each filtration cartridge contains an outer band of fine zeolite media and an inner band of reactive alumina media. Each filtration cartridge also includes a flow control orifice to restrict the maximum operating rate to 0.27gpm/ft<sup>2</sup> of media surface area.

#### **7.8.4 Specific Design Criteria**

##### *Storage of the Water Quality Volume*

Upstream storage must be provided for the water quality/channel protection volume (WQv) which consists of the first 1.0 inch of runoff from impervious surfaces and the first 0.4 inches of runoff from lawns and similar landscaped areas. The WQv should be hydraulically isolated from any additional storage provided onsite by weirs or other means so that only the WQv is routed through the StormFilter. Additionally, the WQv must be detained for a minimum of 24

hours (brimful emptying time) and a maximum of 72 hours.

Storage will typically be provided in an underground facility such as corrugated metal pipe (CMP), polypropylene chambers, concrete vaults or similar means. Since there is likely to be appreciable sediment accumulation in the storage facility a sump should be provided for sediment storage whenever feasible. In the case of CMP or similar facilities this can be accomplished by raising the outlet invert approximately 6 inches from the floor of the system. When chambers are utilized they should be configured such that sedimentation occurs primarily in a specific row of chambers. All storage systems must include sufficient access for maintenance personnel to remove accumulated sediment and debris. If desirable a pretreatment structure can be located upstream of storage to facilitate capture of coarse solids.

#### *Filtration Media*

StormFilter cartridges shall contain an outer band of fine zeolite media and an inner band of reactive alumina media. Each media shall represent 50% of the total media volume.

#### *Cartridge Hydraulics*

Each StormFilter cartridge shall include a flow restricting orifice that limits the filtration rate to a maximum surface area specific operating rate of 0.27gpm/ft<sup>2</sup> of media surface area. Relevant per cartridge operating rates for standard StormFilter cartridge heights are shown in Table 1.

Table 1. StormFilter Cartridge Treatment Flows			
StormFilter Cartridge Height (in)	12"	18"	27"
Media Surface Area (ft <sup>2</sup> )	5	7.5	11.25
Allowable Flow per Cartridge (gpm)	1.35	2.0	3.0
Surface Area Specific Operating Rate (gpm/ft <sup>2</sup> )	0.27	0.27	0.27

#### *Required Number of Filter Cartridges*

To simplify the design of the StormFilter in the State of Maine a relationship has been

established between the WQv and the amount of filtration surface area that is required. This relationship was derived based on the mass of pollutants expected to be delivered to the StormFilter during a typical rainfall year and the amount of mass that is generally captured by the StormFilter before maintenance is required. Ultimately the goal in establishing this relationship was to ensure the StormFilter was capable of operating for at least a year before media replacement is required. StormFilters sized for use in Maine must provide a minimum of 1 square foot of media surface area for every 301.73 gallon (40.34cf) of water that must be treated. Table 2 provides the Water Quality Volume that may be treated by standard StormFilter cartridges.

Table 2. Treatable Volume for Standard StormFilter Cartridges			
StormFilter Cartridge Height (in)	12"	18"	27"
Media Surface Area (ft <sup>2</sup> )	5	7.5	11.25
Allowable WQv Per Cartridge (Gal)	1509	2263	3394
Allowable WQv Per Cartridge (cf)	202	303	454

To determine the appropriate number of StormFilter cartridges for an application, the WQv should first be calculated. Next, a cartridge height should be chosen based on the constraints of the site. Cartridge height is typically governed by the amount of drop available onsite. Taller cartridges result in a smaller system footprint but require more hydraulic drop across the system. Shorter cartridges occupy a larger footprint (larger vault), but require less hydraulic drop. If uncertain about the best cartridge height for a project, CONTECH's design engineers are available to assist. Once the WQv has been calculated for the site and the cartridge size has been selected the WQv can simply be divided by the allowable WQv per cartridge (Table 2) to determine the appropriate number of cartridges. Any decimals should be rounded up to the nearest whole number of cartridges.

### 7.8.5 Construction Criteria

Typically the StormFilter will arrive onsite from the precaster with the internal components already installed. Note that the StormFilter should be kept offline during construction to avoid loading the cartridges excessive sediment. CONTECH will provide applicable drawings and installation instructions prior to installation of the system. The contractor is typically responsible for preparing the excavation for the system, setting the vault or manhole in place, confirming internal components are properly installed, making any necessary pipe connections and installing the risers and covers needed to bring the system to grade. Detailed installation instructions are available at:

<http://www.conteches.com/Products/Stormwater-Management/Treatment/Stormwater-Management-StormFilter.aspx>

Installation of upstream detention structures will vary based on the type of detention structure specified for a particular project. CONTECH provides drawings and installation instructions for each of the detention systems it provides.

Should any questions arise regarding installation contact CONTECH at: *Maine Office*: 207-885-9830 or *National Toll Free*: 800-338-1122

### 7.8.6 Maintenance Criteria

The MEDEP approved configuration of the StormFilter is expected to have an operational longevity of at least one year. To ensure long term performance the media cartridges must be replaced annually. Additionally, upstream storage facilities should be inspected to determine the volume of sediment accumulation. Sediment and other debris should be removed from storage facilities once devoted sediment storage areas have been consumed. Regular inspections provide the best means of establishing maintenance

frequency since pollutant loads will vary at each installation.

#### *StormFilter Maintenance Basics*

StormFilter maintenance is typically performed using a vactor truck.

- 1) Media is vacuumed directly from the cartridges or a place within the structure is used as a staging area to empty cartridges.
- 2) Empty cartridge baskets and components are removed from the structure.
- 3) The structure is inspected for structural conditions and any accumulated sediment and debris is removed from the structure
- 4) New or clean/refilled cartridges are inserted into place.
- 5) Collected sediment and spent media are disposed of off-site, typically at a landfill.

#### *StormFilter Maintenance Indicators*

- 1) Scum line in relation to height on vault wall. If the scum line is above the outlet overflow elevation, then the system has been loaded to the point where overflow has occurred.
- 2) Accumulated sediment on the floor of 4 inches or greater typically warrants full maintenance.
- 3) If the cartridges are in standing water during dry weather and it has not rained in the previous 72 hours, this is direct evidence that the cartridges are occluded. However, the inspector needs to ensure that the cartridges are not submerged due to backwater conditions caused by high ground water, plugged pipes or high hydraulic grade lines. Completely plugged cartridges also can be associated with heavy O&G loading from animal and vegetable fats or petroleum hydrocarbons. If this is the case source control measures are warranted.

A detailed StormFilter maintenance manual is available at:

<http://www.conteches.com/Products/Stormwater-Management/Treatment/Stormwater-Management-StormFilter.aspx>

CONTECH is also available to answer maintenance questions or suggest local maintenance providers.  
Phone: 410-740-8490 or 800-338-1122

Contact for more Information  
CONTECH® Engineered Solutions LLC  
Maine Office: 207-885-9830 or National Toll  
Free: 800-338-1122  
[www.conteches.com](http://www.conteches.com)